

## Application of cone-beam computed tomography in the diagnostics of maxillary sinusitis of odontogenic origin – two case reports\*

### Wykorzystanie tomografii stożkowej w diagnostyce zębopochodnego zapalenia zatoki szczękowej – opis przypadków\*

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#### Abstract

*The aim of the article is to highlight the potential for early diagnosis of maxillary sinusitis of an odontogenic origin with cone-beam computed tomography (CBCT). Two cases of long-term patients treated for maxillary sinusitis of an odontogenic origin are addressed. Dental examination combined with CBCT facilitated correct diagnosis, thus aiding optimal causal treatment. Dental treatment proved a sufficiently effective remedy in one case, whereas the other one required surgical intervention. In the case of suspected maxillary sinusitis of an odontogenic origin, close cooperation of the dentist with an otolaryngologist is recommended at an early stage of treatment. The CBCT facilitates identification of the odontogenic cause of the infection. This imaging technique allows for a simultaneous and accurate assessment of the maxillary sinuses, the teeth, and periapical tissues, whilst eliminating the need for computed tomography of the sinuses and the orthopantomograms.*

#### Streszczenie

*Celem artykułu jest poszerzenie wiedzy na temat możliwości wczesnego rozpoznania zębopochodnego zapalenia zatoki szczękowej (MSDO) za pomocą tomografii stożkowej (CBCT). Przedstawiono dwa przypadki chorych długotrwale leczonych z powodu MSDO. Badanie stomatologiczne i wykonanie CBCT pozwoliło na postawienie prawidłowej diagnozy, a tym samym na podjęcie leczenia przyczynowego. U jednej chorej wyleczenie uzyskano po leczeniu stomatologicznym, u drugiej konieczne było leczenie chirurgiczne. W razie podejrzenia MSDO ważna jest współpraca pomiędzy lekarzem otolaryngologiem a stomatologiem na wczesnym etapie leczenia. Badanie CBCT pozwala na dokładne określenie zębopochodnej przyczyny zakażenia. Uzyskany obraz umożliwia jednoczesną, dokładną ocenę zatok szczękowych, zębów oraz tkanek okółowierzchołkowych. Badanie CBCT eliminuje konieczność wykonania tomografii komputerowej zatok (CT) i zdjęcia pantomograficznego (OPG).*

#### KEYWORDS:

maxillary sinusitis of an odontogenic origin, root canal treatment, cone-beam computed tomography

#### HASŁA INDEKSOWE:

zębopochodne zapalenie zatok szczękowych, leczenie kanałowe, tomografia wiązki stożkowej

#### Introduction

Inflammations of the maxillary sinus are encountered in otolaryngology today with increasing frequency.<sup>1</sup> Some patients would initially seek an appointment with a GP who would then implement treatment. Lack of

appreciable improvement would usually prompt a referral to a specialist to secure more comprehensive treatment. The actual incidence of maxillary sinusitis of an odontogenic origin (MSDO) remains hard to quantify. As the review by Patel et al. highlights, there are no

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current reports detailing the exact percentage of odontogenic factors in the development of chronic inflammation of the maxillary sinus.<sup>2</sup> Most authors believe that MSDO may concern 10-12% of all sinusitis cases.<sup>3-5</sup> New methods of dental treatment, in conjunction with a prevalent trend of sustaining full dental arches, should actually prove instrumental in the rise of the number of odontogenic inflammations, as pointed out by *Hoskinson et al.*, who emphasise an increasing number of MSDO cases in the UK.<sup>6</sup>

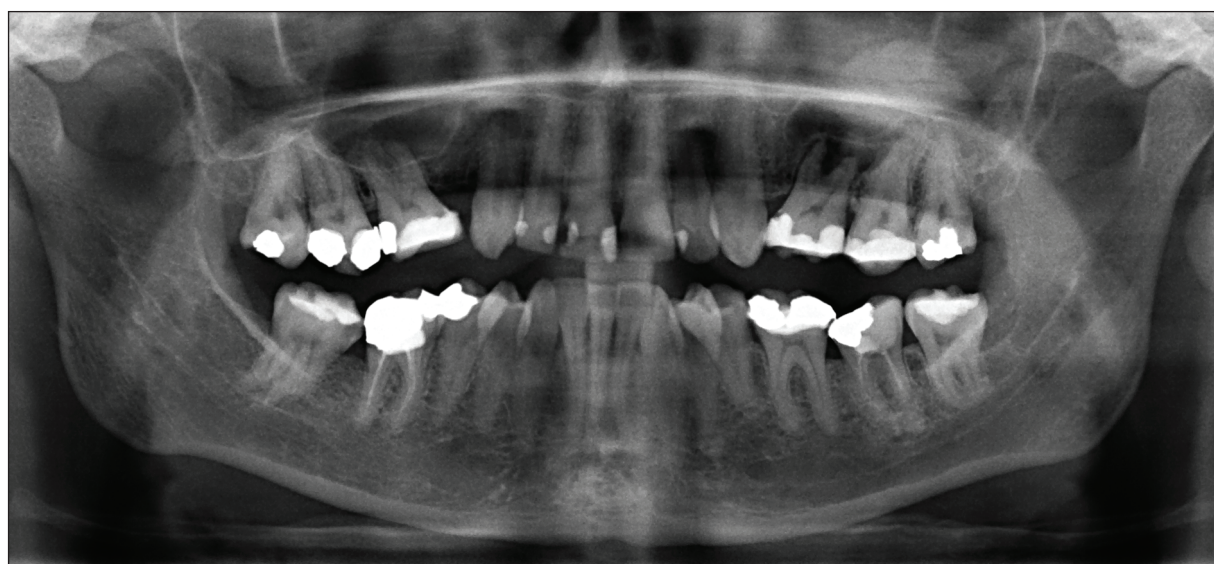
Development of MSDO may be prompted by a disease of the pulp, periapical tissues, periodontal disorders, and may be also due to complications arising from root canal treatment (RCT), or a surgical intervention.<sup>4,5,7,8</sup> Medical history, clinical and radiological diagnostics contribute to effective diagnosing of MSDO. In 1998, cone-beam computed tomography (CBCT) was introduced for diagnostic purposes with regard to the dento-maxillo-facial structures.<sup>9</sup> This tomography scan produces three-dimensional images and facilitates a detailed assessment of the interrelationship between the teeth, periapical tissues and the maxillary sinuses. The application of CBCT imaging is particularly useful in patients with maxillary sinusitis resultant from a pulp and periapical tissues disease, and any undue RCT

complications. Besides, CBCT irradiation dose is significantly lower than the one associated with the CT of the sinuses.<sup>10</sup>

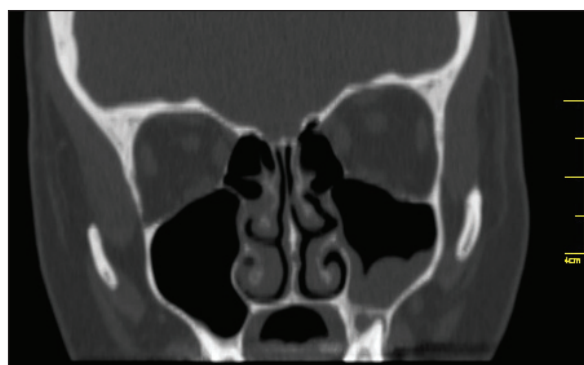
Recently, two patients were treated for MSDO in the Department of Conservative Dentistry with Endodontics. We were prompted to present and discuss both cases in view of previous shortcomings in overall treatment management. Making use of CBCT facilitated an adequate diagnosis, and subsequently helped map out an effective remedial therapy.

### Case 1

A 33-year-old female patient diagnosed with chronic maxillary sinusitis was eventually referred to the Department by an otolaryngologist, following ca. 1-year-long unsuccessful treatment by her GP, pursued with antihistamines, pseudoephedrine and antibiotics. Upon examination the patient complained of facial pain, headaches, ear pain and bad breath. Additional in clinical examination the pulp vitality test of teeth 26, 27 gave negative result. The patient supplied the orthopantomograms (OPG) (Fig. 1), and CT of the sinuses (Fig. 2). The CBCT was conducted in order to have the sinus floor assessed, in particular the morphology and the interrelationship with the surrounding structures of teeth 26, 27 (Fig. 3a, 3b). Development of MSDO was prompted by periapical chronic inflammation



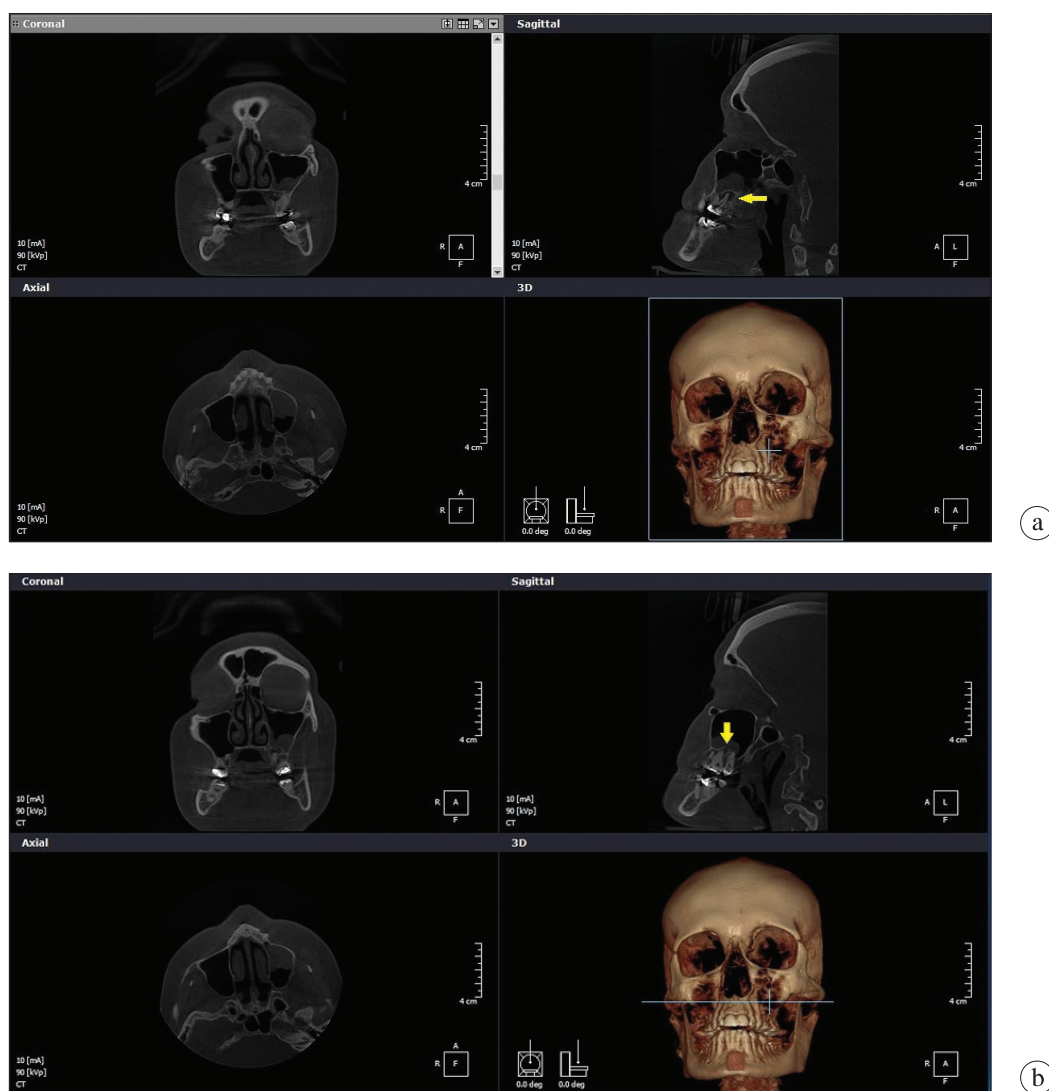
**Fig. 1.** An orthopantomogram showing radiolucency at the apex of teeth 26 and 27, and opacification of the left maxillary sinus.



**Fig. 2.** Coronal CT scan demonstrating the thickening of a mucous membrane of the left maxillary sinus and cystic-like abnormality covering the roots of the molars.

originating in the pulp necrosis induced by the previously conducted treatment of deep caries.

The large bone defect caused by chronic inflammation of the periapical tissues raised justifiable doubts about the actual effectiveness of existing RCT. This notwithstanding, another attempt at the RCT of teeth 26, 27 was undertaken, while the patient was advised of a rather uncertain prognosis. Following the completion of the treatment, a radiograph of the periapical area was taken to confirm that the root canals were filled correctly. After four weeks the patient reported back to the Department due to a local



**Fig. 3a.** A CBCT scan demonstrating diffuse periapical lesions at the apex of tooth 26 (arrow) and the thickening of a mucous membrane of the left maxillary sinus.

**Fig. 3b.** A CBCT scan demonstrating periapical lesions at the apex of tooth 27 (arrow) and damage to the lamina of the sinus floor.



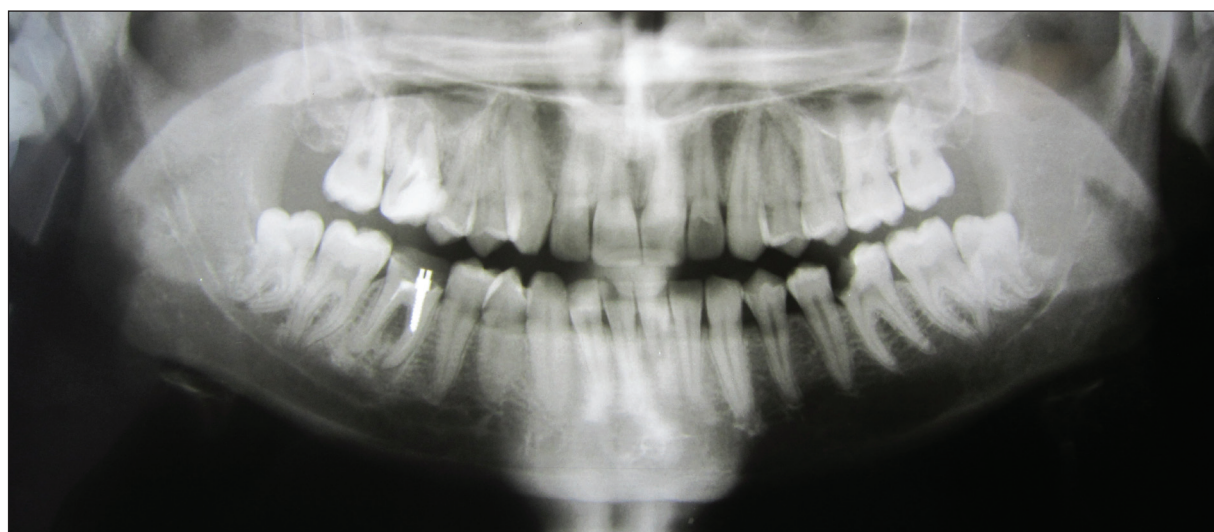
exacerbation. An active purulent fistula was found in the projection of the periapical area of tooth 26. The patient was, therefore, referred for surgical treatment to the Department of Maxillofacial Surgery, where the resection of the apical roots of tooth 27 was completed, tooth 26 was extracted, and the Caldwell-Lucke procedure was applied. Subsequently, the patient reported no further discomfort. Six months after treatment completion, the follow-up CBCT confirmed no active inflammatory process, neither in the sinus, nor in the teeth.

### Case 2

A 19-year-old female patient was referred by an otolaryngologist to the Department to explore

the potential for treating tooth 16, with the accompanying symptoms of inflammation of the right maxillary sinus. The patient complained of facial pain, postnasal drip, an impaired sense of smell, bad breath, and toothache. Symptoms had persisted for over a month. Within that period two punctures of the maxillary sinus were made by an otolaryngologist. Additionally, an intensive medical therapy with antibiotics, decongestants and steroids was pursued, though to no avail.

It was established that two months earlier the RCT of tooth 16 was commenced in response to local pain. It was found that a cavity in tooth 16 had been left unfilled, which resulted in an additional infection of the root canal system. The patient supplied the OPG (Fig. 4), and a radiograph



**Fig. 4.** An orthopantomogram showing radiolucency at the apex of tooth 16 and opacification of the right maxillary sinus.



**Fig. 5.** Radiograph in the Waters projection showing opacification in the right maxillary sinus.

in the Waters projection (Fig. 5). In view of the suspected MSDO and a close proximity of the apex of the roots of tooth 16 to the sinus floor, the CBCT was conducted (Fig. 6). The development of MSDO was prompted by chronic inflammation of the periapical tissues of tooth 16 due to an unfilled cavity. Infection in the root canal system persisted while also causing additional infection with the pathological flora of the mouth. Antiseptic RCT of tooth 16 was completed, and subsequently all root canals were obturated. Ever since the completion of RCT the patient reported no further discomfort. The case was then followed up after four months, whereupon an OPG was taken revealing no further





**Fig. 6.** A CBCT scan demonstrating periapical lesions at the apex of tooth 16 (arrow) and the thickening of a mucous membrane of the right maxillary sinus.

pathological changes, neither to the tooth 16, nor to the right maxillary sinus.

## Discussion

CT is widely used in laryngological diagnostics, as it provides a broad range of vital data on the actual progression of the disease. Its downside, however, consists in its inability to offer an accurate assessment of the teeth, periapical tissues, or the maxillary sinus floor. This is vitally important in diagnosing MSDO, as the odontogenic infections tend to spread either directly from the mouth, following any damage to the sinus floor, and a ruptured Schneiderian membrane, or indirectly through the alveolar jaw by Havers and Volkmann channels.<sup>11</sup> Introduction of CBCT into standard diagnostic procedures effectively eliminates this appreciable disadvantage, as well as the need for OPG and periapical radiographs.

In the case of the first patient, it took 12 months to offer a conclusive diagnosis. In the second case, the diagnosis was much faster to come, although the actual direction of the treatment itself seemed dubious. That treatment was most likely anchored in the still prevalent approach to the issue, whereby an inflammation of the odontogenic origin is deemed an extremely rare condition. It should also be acknowledged that both an interview with a patient and the results of a clinical examination

may be misleading. In the tooth previously treated for caries, which appears quite healthy in a clinical study inflammation of the pulp and the periapical tissues may develop, and subsequently become the source of infection for the maxillary sinus. Similarly, in the case of the teeth following the RCT; periapical lesions may appear as the result of as e.g. complications during a RCT procedure. A retrospective analysis of 204 CBCT studies, as made by *Brullmanna* et al., effectively corroborated the link between the inflammatory reaction in the floor of the maxillary sinuses and root canal-treated teeth, affected either by caries, or periodontal, or pulp disease.<sup>12</sup> *Uliasz* et al. assessed 844 patients with chronic maxillary sinusitis. In this group in 19.3% of the subjects the cause of sinusitis was established as resultant from the complications accompanying RCT, teeth with periapical lesions and periodontitis.<sup>8</sup>

Chronic periapical inflammation usually tends to have an asymptomatic course. It is most likely for this reason that with regard to the first reported case the odontogenic factor was detected late, when the inflammation was already well advanced. It might, therefore, be assumed that an early dental intervention might well have resulted in a therapeutic success. The other one of the two patients had the primary RCT discontinued in mid-course, so the tooth cavity was left unfilled,

and subsequently an infection of the entire root canal system set in. A properly completed RCT ultimately had the problem rectified. In both cases, the CBCT test proved a decisive diagnostic factor.

Both patients remained under long-term treatment, and had been subjected to numerous radiological examinations which generated costs, whilst failing to ensure effective diagnosis. The odontogenic factor was taken into account as a potential causative element only after no improvement was observed following routine treatment. Far too late an involvement of a dentist in overall diagnostic process resulted in unnecessary pharmacotherapy, and generated extra costs for the patients. Besides, in the first of the two cases, a surgical intervention was ultimately required.

## Conclusion

Diseases of the pulp, periapical tissues, periodontal disease and potential complications accompanying RCT are often overlooked as the etiological factors in inflammation of the maxillary sinus. This generates additional costs related to the treatment of symptoms, whereas the true cause of inflammation remains undiagnosed. A CBCT survey should be carried out as the initial diagnostic procedure in the event of a unilateral inflammation of the maxillary sinus. It is, therefore, essential that during any MSDO treatment an otolaryngologist should work in close consultation with a dentist, in particular with an endodontic specialist, and a maxillofacial surgeon.

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